THE EXPLOSIVES ENGINEER

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Forerunner of Progress in Mining, Quarrying, Construction

Blue Diamond Corporation's strip-mining operations are in rich gypsum deposits near the tops of steeply rising bluffs of the Spring Mountain Range in southeastern Nevada near Arden, 23 miles from Las Vegas. As in many such operations, the surface mining is a dual project – blasting and stripping the overburden and then blasting and recovering the gypsum rock. The tonnage of waste material disposed of is about equal to that of the recovered gypsum.

Although the mine is located in a dolomite area of sedimentary rocks, the overburden is primarily limestone, almost cherty hard, averaging 27 ft. in depth. It is difficult material to drill and is rough on the equipment.

Blue Diamond's production in Nevada each day runs at approximately 400 tons of sacked gypsum plaster of all types and a million sq. ft. of board and lath products. Mine and plant output are keyed close to sales, and there is comparatively little storage.

A comprehensive description of this busy operation in lonely, desert country is given in the article by Lewis Nordyke, beginning on page 167.

* * *

The job of constructing the West Delaware Tunnel through a section of the Catskill Mountains near East Branch, New York, was awarded by the Board of Water Supply of the City of New York to a combination of five prominent firms in a joint venture. The sponsoring contractor handling the construction details is Johnson, Drake & Piper, Inc., of New York City.

Rapid progress on the job has been highlighted not only by record-breaking tunnel advance but also by instruction courses in first-aid work for the hard-rock tunnel employes, with U. S. Bureau of Mines' personnel the teachers.

EDITORIAL STAFF: Joseph I. Horty, *Editor;* James J. O'Neill, *Assistant Editor;* Gertrude A. Donnelly, *Associate Editor;* Edward L. Grant, *Art Editor;* Howard B. Dickson, *Production Manager;* Charles E. Rabenold, *Advertising Manager;* Montgomery R. Budd, *Director.*

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Views and opinions expressed by the authors of articles in this publication are their own, and they do not necessarily represent those of the publisher.

For a detailed account of the operating procedures that result in an advance of more than 60 lin. ft. in a 13½-ft.-diameter tunnel each day, please turn to page 177.

* * *

Two old-timers in the heavy-construction field have been chosen to receive the 1958 Moles Awards – Peter F. Connolly, president of the company which bears his name, and Francis Donaldson, vice president and a director of Mason & Hanger Company. Official award ceremonies will take place at the annual dinner of The Moles on January 29, at the Waldorf-Astoria Hotel in New York.

More details of this recent announcement may be found on page 182.

* * *

The article describing the ceremonies at which Sentinels of Safety trophies and flags were officially awarded to the six winners of the National Safety Competition begins on page 183. The description is prefaced with a brief summary of the events that lead to the start of this nation-wide contest in Washington, D. C., in 1924, with the approval of the then-Secretary of the U. S. Department of Commerce, Herbert Hoover.

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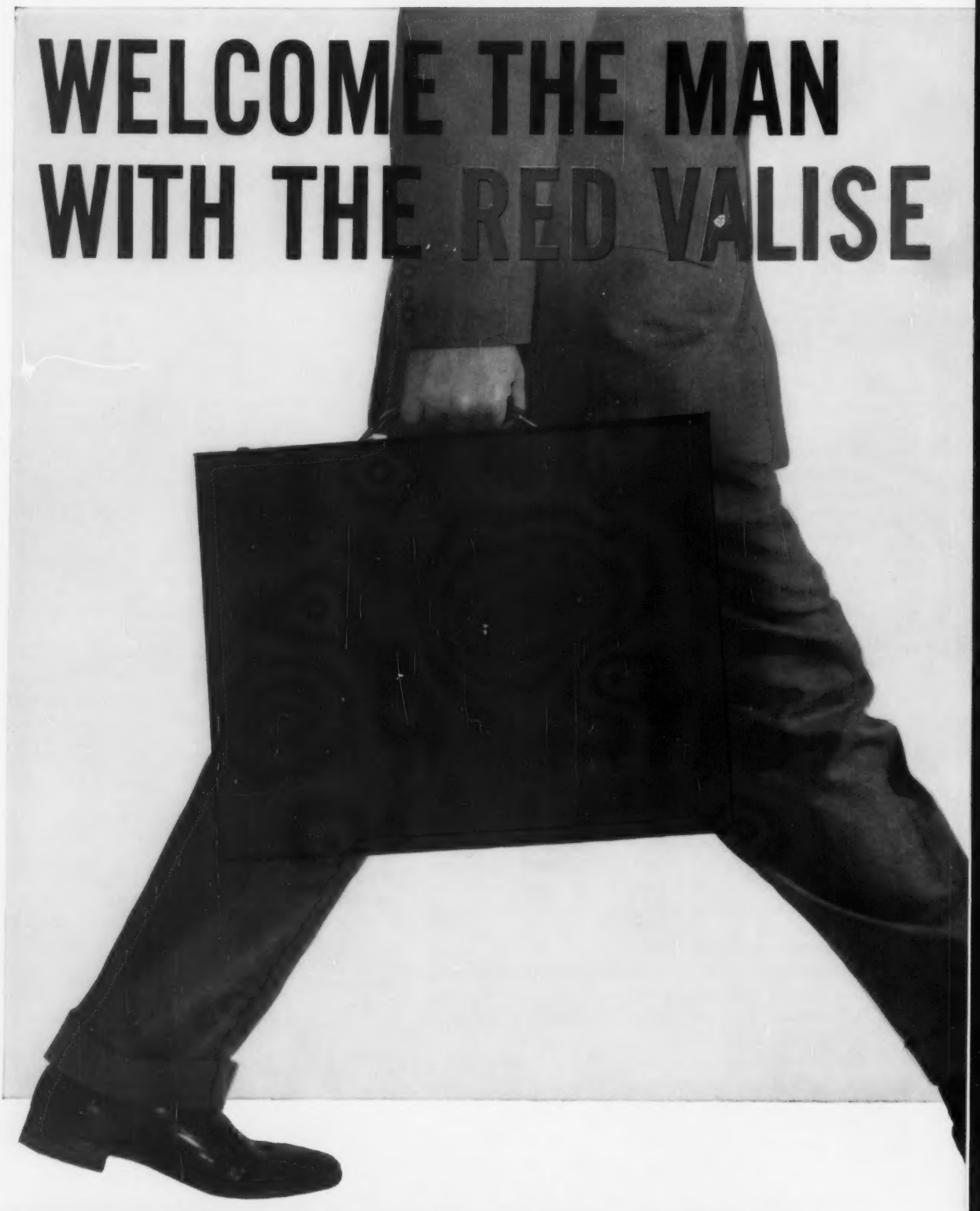
WELCOME THE MAN WITH THE RED VALISE



HERCULES® BLASTING CAPS

Partners in Dependability with Hercules® Explosives

He can show you why Hercules sets the pace in Blasting Caps

Whatever you need in a blasting cap, Hercules has it—And the Hercules representative can show you an actual dummy sample from this "full line" kit. The Man with the Red Valise will be calling on you soon—if he hasn't already—and when he does you'll learn why Hercules is a recognized leader in blasting cap development.

Look at this Hercules lineup:

Electric Blasting Caps — Manufactured in two strengths with plastic-coated copper leg wires available in lengths from 4 to 250 feet.

Waterproof Electric Blasting Caps — Designed to withstand high water pressure.

No Vent® Delay Caps — One-piece, all-metal shell. No Vent helps prevent misfire in wet work. Available in delay periods from "0" to "15." An exclusive Hercules development.

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Electric Squibs — Special firing devices for use with black blasting or pellet powder where electricity is employed.

Special Packings — All-electric blasting caps in leg wire lengths of 20 feet and above, but not exceeding 250 feet, may be obtained packed on cardboard spools for easier handling. Primatube,® a rigid cardboard tube available for some types of caps, makes a primer when the tube is fitted over a dynamite cartridge.

Seismic Aids — Vibrocap® SR has been designed especially for seismic prospecting; it registers the "time-break" accurately throughout the entire range of low and high firing currents. Titan® Booster 20, a special booster detonating device for use with regular Hercules® Electric Blasting Cap or Vibrocap® SR, is also available.

You name it and the man with the Red Valise will show it to you.

HERCULES CAPS FEATURE:

Dependable Fire — Special alloy is used as the bridge wire in the firing element of Hercules Electric Blasting Caps. Wire is noncorrosive.

Engineered Shell — Bronze shell of a Hercules cap goes through fifteen separate operations while it is being expertly shaped.

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Double-Packed Wallop — Bridge wire extends into the priming charge and makes positive contact to give rapid ignition.

Securely Anchored — A cast sulfur plug in the upper part of shell anchors entire firing mechanism in place.

Watertight Waterproofing — A special Hercules waterproofing formulation minimizes the possibility of moisture or dampness penetration.

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XR57-6

Effingham Perot Humphrey

PRESIDENT

STONEGA COKE AND COAL COMPANY

A Biography

The career of Effingham Perot Humphrey, president of Stonega Coke and Coal Company, offers another example of the rewards that accrue from early devotion to a chosen field, sound training in the fundamentals, wide experience, and a sympathetic interest in those who are associated with him.

Ham, as he is known to his friends and associates, was born in Wilkes-Barre, Pennsylvania, on March 31, 1893, the son of John M. and Marie Louise (Schatte) Humphrey. His father, a graduate of Lehigh University in 1889, began his association with Lehigh Valley Coal Company in 1892, in its engineering corps. Subsequently, he was elected president of the company.

Ham completed his elementary education at Centralia, Pennsylvania, High School and Bethlehem Prep. He matriculated at Lehigh University and was graduated in 1915 with a B.S. degree in mechanical engineering. His extracurricular activities at the university included elections as manager of the lacrosse team and of the college paper, and a member of Arcadia, the student governing body.

In the summer of 1911, Ham took a job with Goyne Steam Pump Company to work in the shop and on erection projects. While at Lehigh, he worked during vacation months in the mechanical engineering department of Lehigh Valley Coal Company. Following his graduation from the university, he went to work full time with the coal company in this department, primarily on breaker construction.

In 1917, Ham accepted an offer from Hazle Brook Coal Company (anthracite) to become assistant superintendent. During the next thirteen years, he was advanced through various positions of responsibility, culminating in his appointment as the company's general manager.

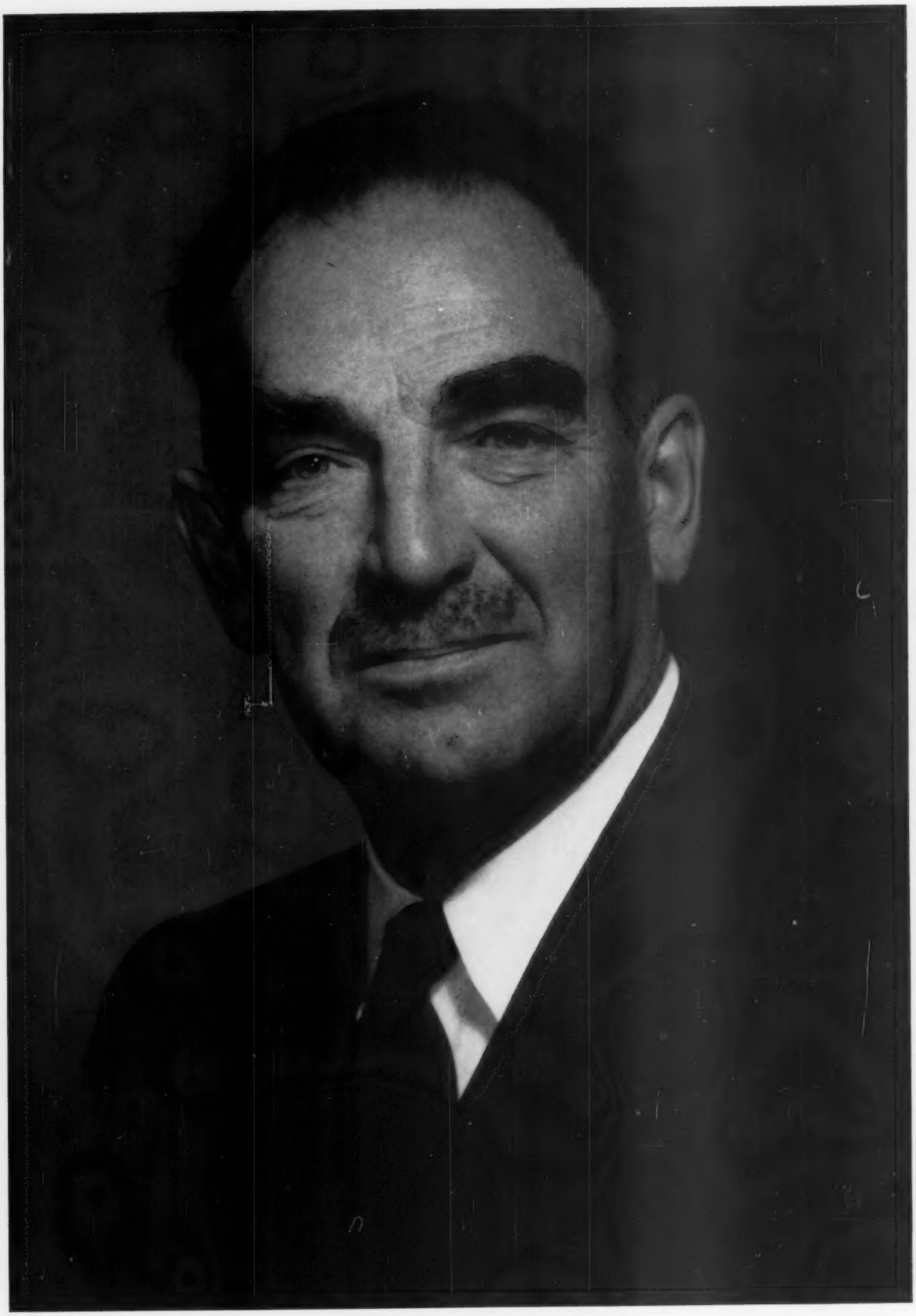
In 1930, he joined Lehigh Navigation Coal Company (anthracite) as superintendent of strip-mining, construction, and preparation activities. Six years later, he left the anthracite field to accept the vice presidency and membership on the board of directors of Stonega Coke and Coal Company, operators in the bituminous field. In 1951, he was elected president of the company, the position he holds today.

Mr. Humphrey's other business affiliations include vice president and a director of Westmoreland Coal Company; Westmoreland, Inc.; Virginia Coal & Iron Company; General Coal Company; and Wentz Corporation. He is a director of Bituminous Coal Operator's Association; Bituminous Coal Research; American Briquet Company; Interstate Railroad Company; Central Supply Company of Virginia; Clear Creek Water Company; Cumberland Water Company; and Virginia Wholesale Company, Inc. He is a member of the American Institute of Mining, Metallurgical, and Petroleum Engineers; the Military Order of the Loyal Legion of the United States; and Phi Gamma Delta fraternity.

His clubs include Merion Cricket, Midday, and Corinthian Yacht of Philadelphia.

Effingham Perot Humphrey married Margaret Blair Howell in Wilkes-Barre on December 29, 1917. They have four children: E. P., Jr.; Margaret Blair; Marie Louise (Mrs. Richard H. Warren); and Joan Howell (Mrs. T. Whitney Barker). The family home is at 542 Glyn Wynne Road in Haverford, Pennsylvania.

Ham Humphrey finds relaxation aboard his motor sailer on Chesapeake Bay, in hunting and fishing, in making copies of antique furniture in his woodworking shop at home, and as a collector of stamps – specializing in United States, Canada, and Bermuda issues.



EFFINGHAM PEROT HUMPHREY

Merry Christmas - Happy New Year

The members of the editorial staff of THE EXPLOSIVES ENGINEER welcome this opportunity to extend holiday greetings to our readers and friends. It is our earnest hope and prayer that during the year just ahead "Peace on Earth, Good Will Toward Men" may come to all of you.

Editorial

Safety is Good Business

Safety on the job is essentially good business. Today, practically every progressive employer has someone on the executive staff who is responsible for the safety of all employes. But, the appointment of such a specialist is not enough; he must have the day-to-day support and encouragement of top management personnel in the maintenance of a continuing program of education and safeguards.

The mineral industry has become more and more alert to the increasingly important role of accident prevention in conserving manpower and maintaining output. This is particularly true in this period of high production costs and intensive competition. Safe working conditions and practices go hand in hand with efficient and economical operations. There is a greater realization that accidents can be eliminated, or at least greatly reduced, by taking positive action. It is not luck that gains enviable results, but sincere determination plus the application of every available means.

Well-planned, well-directed campaigns to prevent accidents in mines and quarries, and on construction and seismic exploration projects, result in benefits that outweigh the cost in money and effort. These benefits are shared by all concerned – workmen, management, and stockholders. Such campaigns are successful only when the management personnel is firmly committed to support them.

The motives that inspire safety work are not important. The well-being and productiveness of employes, the efficiency of management, and the profits to stockholders will be increased with equal certainty whether plans for accident prevention are based on the desire for greater gains, or on the highest ideals of humanity.

Enrollment in the National Safety Competition has proved helpful in stimulating and maintaining interest in safety among the workmen in mines and quarries. We urge you to enter your plant in this nation-wide contest. Address your communication to the Chief of the Accident Analysis Branch, Division of Safety, U. S. Bureau of Mines, Washinton 25, D. C. Complete details for entrance will be gladly and promptly sent to you.

Keep Abreast of the Times

The preparation of coal begins at the face – with the explosives and the blasting methods used to bring down the coal. If these operations are not done properly in the first place, expensive loading equipment and preparation facilities cannot completely offset marketing disadvantages.

Today's permissible explosives, with their lump-producing action and added safety features, have proved to be valuable aids in the mining and preparation of coal in many mines. The progress made in the development and scientific application of permissibles, notably the introduction of king-size cartridges, merits the attention of coal mine operators, large and small. Since explosives constitute an important item of expense in the mining of coal, every analysis of operating costs should include careful thought and consideration as to their selection and use.

To keep abreast of the times, operators should conduct periodic investigations of explosives and blasting procedures with trained representatives of explosives manufacturers. Such a program will also be helpful in realizing more fully on mechanical investments.

Another Record for Railroads

H. A. Campbell, chief inspector of the Bureau of Explosives, Association of American Railroads, reports that 1956 marked the 35th consecutive year in which no persons were killed or injured in connection with the rail transportation of Class A commercial explosives.

This remarkable record is a tribute to the care and skill with which the railroads handle shipments of explosives. Credit is also reflected upon the stability of the explosives produced by American manufacturers for industrial purposes, and the ingenuity with which these explosives are packaged, loaded, and braced for shipment in freight cars.

The Bureau has made and is making a daily contribution to safety and welfare throughout the nation. We salute our rail carriers on their outstanding accomplishments in the safe transportation of explosives for industry.

Blue Diamond's Gypsum Works In Nevada

An overburden of hard, cherty limestone 27 ft. deep has to be blasted and excavated before an underlying deposit of gypsum rock can be mined and processed

LEWIS NORDYKE *

IN the rugged country between the desolation of Death Valley in California and the lights of Las Vegas in Nevada is a strip mine in which the operator must be as clean-handedly careful in blasting and processing as a miller is in grinding the finest of flour.

The mine is a part of the Blue Diamond Corporation's Gypsum Works in Clark County, Nevada.

The corporation, with headquarters in Los Angeles, is a large producer of basic building materials, featuring high quality. Products made of gypsum must come up to rigid standards. Therefore, Blue Diamond uses every

*2809 Lipscomb Street
Amarillo, Texas

DESERT COUNTRY: The desert country in southeastern Nevada is lonely but spectacularly beautiful with bleak cliffs rising high in the sky. A few Joshua trees are the main vegetation. This place of plenty of solitude is in sight of Blue Diamond's busy mining operation.

RELICS OF THE PAST: In the early days the gypsum deposit was mined underground, using the room-and-pillar method. With the coming of improved excavation equipment and blasting techniques, mining was changed to open-pit methods.

precaution to guard against impurities or anything that might cause discoloration. The use of copper leg wires on electric blasting caps or in a firing line for blasting the gypsum rock could leave flecks that might smear and ruin batches of material. The Blue Diamond Corporation takes no chances on such mishaps; it uses only blasting caps with aluminum shells and iron leg wires in detonating blasts. The caps disintegrate completely and the wire scraps are picked up with magnets.

The gypsum rock in place in the ground is almost pure and it has to be kept that way. It looks odd to see the clean, white stuff coming out of such brown, dead-looking hills.

The far-famed Strip of Las Vegas is only 23 miles away, but the glitter of the gaming resort, with its hotels, casinos, and high-priced entertainers, is little more spectacular than the Blue Diamond operation. The country is lonely and beautiful with weathered bluffs frowning down on deep, winding canyons. It is mainly desert land, but out in the hazy distance one can glimpse an occasional green valley with clumps of trees. Standing on the rim of the mining area, one can gaze across a wide stretch of barren landscape and see the famous Bar Nothing ranch house sequestered among tall trees; it was once owned by Chet Locke, the Lum of the Lum 'n' Abner radio team of comedians, but is now the property of the Krupp family of German arms makers. Obviously the desert is a place of plenty of solitude, although it is in sight of a busy mining operation.

The gypsum deposits are near the tops of a series of steeply rising bluffs towering along the foothills of the Spring Mountain Range in the southeastern part of Nevada. The altitude in the mining area varies from 4,300 to 4,750 ft. above sea level. The plant and the camp, which is an inviting village, are at the base of the bluffs, far below the gypsum pits. The plant was located down there because of the availability of the Union Pacific Railroad and also because the raw material could be hoisted over the face of a high cliff by aerial tramway.

Mining Began in 1909

The presence of rich gypsum deposits in the Spring Mountains has been known since Hector was a pup. The first mining was started near Arden, Nevada, in 1909. Operations were abandoned when the gypsum gave out. The Blue Diamond Corporation has no worry about reserves; the deposits are sufficient to last for many years. Prospecting over a wide area has proved this.

Blue Diamond started its Nevada operation in 1923 and produced its

first carload of gypsum on a hot July day in 1925. However, the company is older than that. Officials are often asked whether their company mines diamonds. A Blue Diamond sign on the Los Angeles-Las Vegas highway indicates the road to the mine and mill; this sign puzzles many wide-eyed travelers who ask at service stations about "the diamond mine in the hills." The company received its name not from sparklers but from lime deposits.

At about the turn of the century, J. W. Jamison owned quarries and kilns near Tehachapi, California. His lime deposits were the best he had ever seen. He called his product "blue diamond" because he figured that its quality among limes was comparable to that of the blue diamond among precious stones. In 1915, Jamison, with plenty of good lime, teamed up with William Hay, who had patented a process for ready-mix mortar. They named their company Blue Diamond and from that modest beginning it has grown into a multimillion-dollar manufacturer and distributor of building materials, particularly in California.

The company built its first small gypsum plaster mill in Los Angeles in 1922. The first rock for it was shipped from Imperial Valley in California.

A year later, W. G. Bradley, now vice president and director, joined the company. He was an experienced gypsum-production man. He took a good look at the present mining location in Nevada, saw great prospects there, and Blue Diamond bought the property.

With proved reserves in sight, the company started development, first constructing a road up the mountain. The mine was opened. Gypsum rock was shipped to the Los Angeles plant until 1941, when that installation was moved to the new town of Blue Diamond, Nevada, and vastly expanded. After that move, the project became a fully integrated operation of mining, ore dressing, and manufacturing.

Methods of Mining

The first mining, back in the 1920's, was by the open-pit method, the material coming from spots where the overburden was not too thick. Soon, however, mining operations went underground. The room-and-pillar method was used. In the 1940's, with the advent of effective excavation equipment and improved techniques

DRILLING GYPSUM ROCK: After the overburden of limestone 24 to 30 ft. thick has been removed, blast holes are drilled 16 ft. deep on 6-ft.-square centers into the gypsum bed. Fragmentation is satisfactory and very little secondary blasting is necessary.

in blasting, some open-pit mining was started. In 1954, the underground mining was abandoned and the whole works was adapted to the open-pit system, which is effective today.

As in many such operations, the surface mining at Blue Diamond is a dual project – blasting and stripping the overburden and then blasting and recovering the pay stuff. The tonnage of waste material, which can be classified with the eye, is fully equal to that of the gypsum.

Stripping the Overburden

Stripping the overburden is a blasting and excavation operation equal in size to almost any similar activity in the West. Although the location of the mine is in a dolomite area of sedimentary-type rocks, the limestone capping the gypsum is siliceous and almost cherty hard. This limestone is more than 30 ft. thick in places, averaging from 24 to 30 ft. It is hard to drill and it's rough on equipment.

In stripping the limestone, blast holes 6¼ in. in diameter are drilled on an average of 30 ft. deep – through the bench and into the gypsum bed. They are spaced 15 ft. apart. From 50 to 140 holes are fired at a time, creating a muck pile of from 15,000 to 30,000 cu. yd. of material.

The drilling is done with a Joy Heavyweight Champion. The turntable and hydraulic setup is a GMC 371. A Joy compressor of 427 c.f.m. and powered by a GMC 671 furnishes the air. Hughes Tri-Cone bits are used. The Joy drill makes from 150 to 300 ft. in an eight-hour shift, the progress depending largely on the hardness of the siliceous limestone. A bit drills from 300 to 1,000 ft. before it is too dull to use.

The blast holes are loaded on a ratio of 0.8 to 0.9 lb. of explosives to 1 cu. yd. of material in the solid. The equivalent of Hercules Bag (free-flowing) powder of 65% strength is used. A cushion of 25 lb. of powder is poured into the bottom. This is followed by a 3 by 8-in. cartridge of Hercomite® 2 primed with an electric blasting cap and reinforced Primacord.* When the hole is filled with powder to a point near the surface, it is stemmed to the collar with drill cuttings.

Short-period delay electric blasting caps with 16 periods of delay are used. When more than 16 holes are fired, which is usually the case, the delay caps are staggered to give the maximum amount of relief.

All the loaded holes are connected in a single series and the blast is fired with a conventional blasting machine.

Primary blasts handled in this way achieve satisfactory results. The muck is waste and has to be reduced only small enough for the shovels to handle. So, no secondary blasting is required.

The blasted material is excavated with a Link-Belt Speeder K-580 diesel-powered shovel with a 2½-cu. yd. Amsco dipper. The shovel loads into 27FD Euclid end-dump trucks for transportation to the nearby waste disposal area in a canyon. A Bucyrus-Erie 38-B shovel with a 1½-cu. yd. dipper is alternated in excavating and

*Reg. U. S. Pat. Off.
by The Ensign-Bickford Company

AFTER A BLAST: After a blast the broken gypsum rock is excavated with a 1½-cu. yd. Link-Belt power shovel which loads into 31TD Euclid trucks of 30-ton capacity, equipped with oil hydrotarders.

PROCESSING BEGINS: The trucks loaded with blasted gypsum pull out of the mine and end-dump their contents into a chute that leads to a Sheridan grizzly which discharges into a 54 by 70-in. Jeffrey pulverizer.

loading out waste and gypsum. Four trucks, with built-up sideboards to increase the capacity, handle the waste hauling. A Caterpillar D-8 does the blade work in the pit, cleaning up around the shovels and keeping the haulageway cleared.

Blasting Gypsum Rock

When the overburden has been stripped and removed, mining for pay dirt starts. As a rule, the excavation of the overburden leaves a layer of gypsum and limestone from 6 to 18 in. thick on top of the gypsum bed. This is usually removed with a blade ripper on a Caterpillar D-8. However, at times this layer is drilled with jackhammers and blasted. The holes are loaded with 1-in.-diameter cartridges of Hercomite 7 and the charges are fired with blasting caps and safety fuse. The blasted layer is then dozed away, exposing the bed of gypsum rock. This bed is cleaned to about the whiteness of a hound's tooth before it is worked, first by explosives and then by excavating equipment.

Being somewhat inert, gypsum rock is difficult to break. Blue Diamond has experimented with various methods of drilling patterns and types of explosives and has developed an effective system of blasting.

A round of holes, ranging from 150 to 400, is drilled in a block of gypsum on a bench that averages about 15 ft. The 2¼-in. holes are drilled 16 ft. deep on 6-ft.-square centers.

The two drills on this job have been adapted to the work by the Blue Diamond mine operating staff. Both are Ingersoll-Rand 55-J's mounted on an Air-Trac carriage which is propelled by air motors on the tracks. Kennemetal two-pronged auger bits are used.

Air for the drills is supplied by three Ingersoll-Rand Gyro-Flo compressors of 600 c.f.m. each. Air pressured through the bits blows out the cuttings. Drilling progress is in excess of 7 ft. a minute.

Loading Explosives Charges

The holes are loaded on a ratio of 0.5 to 0.6 lb. of explosives to the ton of gypsum in the solid.

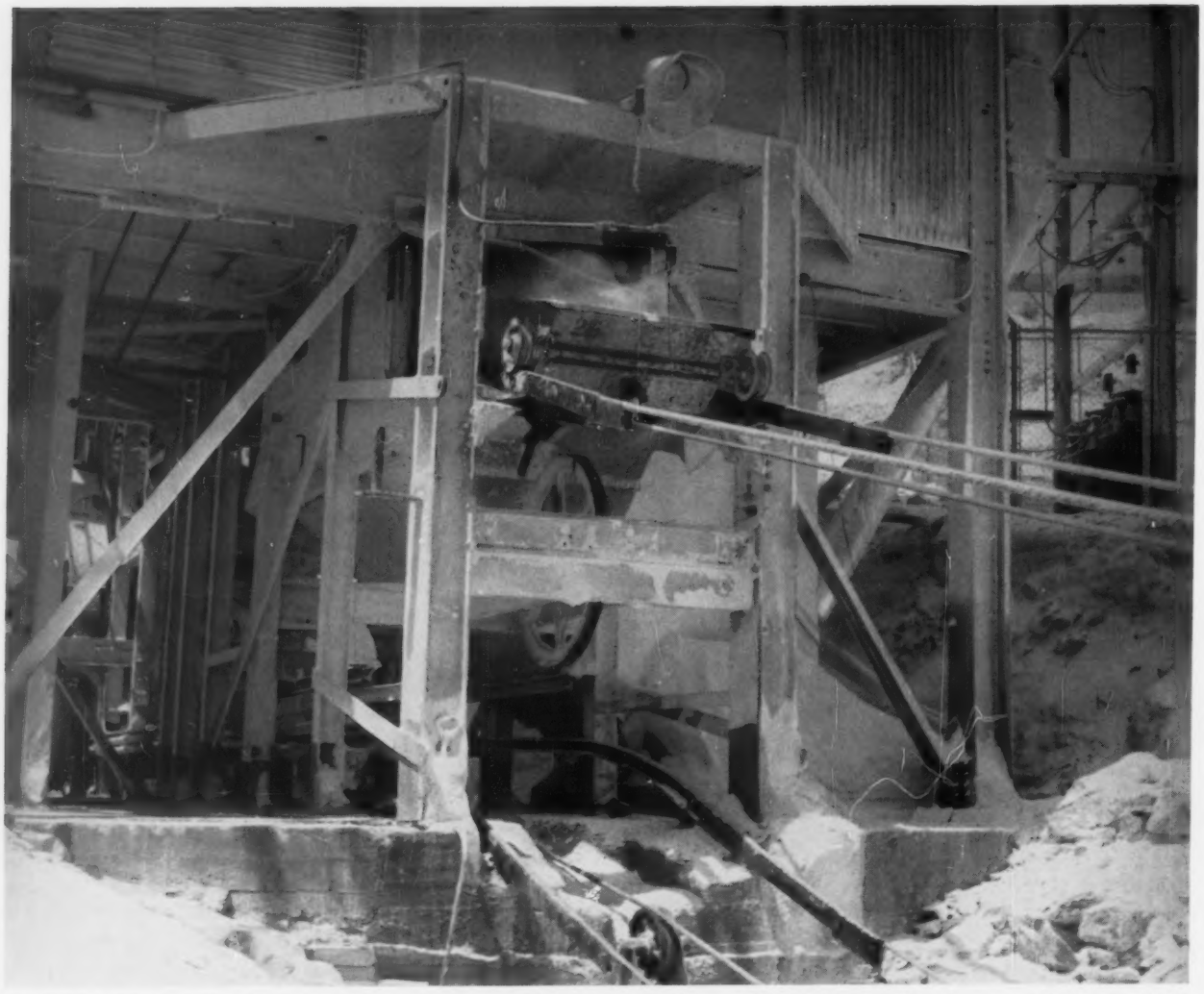
Each hole is given a cushion of Hercules Bag X powder. Then follows a 1½ by 12-in. cartridge of Gelamite® 2 primed with an MS aluminum blasting cap with iron leg wires. The hole is filled with Hercules Bag X powder to within 12 to 18 in. of the surface and then stemmed with drill cuttings. The round is fired with a blasting machine.

Fragmentation has been quite satisfactory, and there is very little secondary blasting. The gypsum deposits occur in gently westward-dipping sedimentaries, and block faulting has disturbed the formation. At times the slip planes in the gypsum block cause poor breakage and, in such cases, there is secondary blasting. Drilling for this is with hand-held air augers which cut 1¼-in. holes. From one to two holes may be drilled into a block. The holes are loaded with 1 by 4-in. cartridges of Hercomite 7 primed with aluminum caps and safety fuse. After blasts are fired a Caterpillar D-8 dozer cleans up.

Excavating Blasted Gypsum

The blasted material is excavated by a 1½-cu. yd. Link-Belt power shovel, which loads into 31TD Euclid trucks equipped with oil hydrotarders. At times the Bucyrus-Erie 38-B is used in excavating and loading gypsum when not in use in the stripping operation.

The trucks are of 30-ton capacity. Two trucks are kept on production



LOADING A TRAM CAR: The pulverized gypsum is conveyed into two 125-ton bins which feed into measuring hoppers at the bottom of the bins. This picture shows a tram bucket or car being loaded from a measuring hopper.

and the third is held as a standby.

Aside from the drills, shovels, and trucks, the principal equipment in the mine includes D-4, D-8, and D-9 Caterpillars and a GM truck.

Maintenance of mine equipment is handled in a large Quonset located on a hill between the mining area and the crusher. Major repairs and overhauls are also made here. One of the big maintenance jobs is along preventive lines – protecting equipment against gypsum dust, which is particularly bad in the dry, hot climate, and the abrasive limestone capping. Bearings and air-cleaners are watched carefully. The gauge of the drill stems on the Joy Heavyweight Champion unit is built up by the application of welding rod. Shovel dipper teeth, crawler tracks, and sprockets are likewise hard-faced.

Although the grades are steep in places, the haulage is short. The gypsum trucks pull out of the pit and haul to the rather spectacular equipment that takes the material to the mill. The end-dump trucks unload into a chute leading to a Sheridan grizzly feeder. From there on to the mill the work is downhill, for the crusher is located on the rim of a 1,000-ft. bluff known as Blue Diamond Hill. It is above and about 3,800 ft. away from the plant.

Mill Operations

The Sheridan feeder discharges the gypsum rock into a 54 by 70-in. Jeffrey swing hammer pulverizer, which reduces the rock to minus 2 in. Since gypsum crushes easily, most of the material is on the minus side. The crushed gypsum is conveyed into two 125-ton bins, which feed into a measuring hopper at the bottom of the bins.

An Interstate Loop-Line aerial tram hauls the gypsum to the plant. It has 54 buckets, or cars, on the line, half of them going down and the other half going up all the time. The buckets are on two-track cables, which are supported by structural steel towers. On the upward trip the buckets are upside down. In going around the shaft just before moving under the hopper, they are turned right side up and are ready to receive their loads. As a car goes under the measuring hopper, the swing bottom, which is controlled by an automatic trigger mechanism, dumps 1,800 lb. of gypsum. The car doesn't pause.

Overflow is caught in a second hopper and returned by conveyor to the measuring hopper, preventing waste.

The tram delivers approximately 1,200 tons daily to the plant which, in reality, is several plants turning out several products. The main ones are lath stucco; wallboard stucco; hard wall; dead white plaster; and casting, 98 per cent gypsum with no grit whatsoever. This takes in the full range of plasters. One section of the plant turns out lath, perforated and plain. The board plant makes products in thicknesses of ¼ in. up, 4 ft. wide, and up to 16 ft. long.

The mining superintendent knows from previous tests the type of gypsum in all areas of the mine. With this information, and by sight judgment, he classifies the material and sends to the mill what is needed.

The tram buckets dump into a bin, and the mill is fed from this bunker, or tram terminal, the material going first into bins where it is carefully separated as to type of product.

The first separation is the screening out of ⅜ to 1-in. material, which goes to cement plants. Blue Diamond makes Portland cement in Southern California and uses a great deal of this gypsum in the cement plants.

Processing Gypsum

The processing of gypsum, regardless of the product it goes into, is based largely on the fact that it is one material which always returns to its original state when treated with its natural content of moisture. Pure gypsum coming out of the brown hills contains 20.9 per cent water of crystallization. It can be calcined, or dehydrated, down to about 6 per cent and ground into a very fine plaster. It remains in that state until it is made workable by the addition of water. When the moisture content is brought back to 20.9 per cent water of crystallization, the gypsum returns to its original state, and that's what makes it so useful as plaster, casting, wallboard, and other building material. Among its other qualities, it resists fire; when subjected to intense heat gypsum wallboard emits steam and keeps the enclosed wood studding or steel at a relatively low temperature until the gypsum is completely calcined.

So, working gypsum is a matter of taking out and adding water. The various gypsum products made by Blue Diamond are improved by adding such material as resin (to produce minute air-bubble voids), potash, cornstarch, flour, steel strapping, bundling tape and paper (for board products). Strong fiber—finely ground pulp, often

THE AERIAL TRAM: Gypsum is hauled to the plant by an Interstate Loop-Line aerial tram equipped with 54 buckets on two-track cables. The tram makes deliveries of 1,200 tons of gypsum each day.

referred to as "hair" – is added to plaster to strengthen it.

From the rock bins the raw gypsum goes first to a Raymond pulverizing mill where it is reduced to fine powder. Then it goes to seven large calcining kettles in which the correct amount of moisture is removed. Material destined to become plaster and to be shipped away in bags is conveyed to a regrind bin where buhrstones grind it to a fine plaster consistency.

The Board Plants

The first board plant was built in 1941 when the mill was moved from Los Angeles and enlarged. The whole works, including the boiler plant, has been expanded a great deal since that time – a second board plant was added in 1954. The board plants are perhaps the most interesting, since they turn out products that are used in nearly every home.

Calcined gypsum goes by screw conveyors from the hot pits to storage bins in the board plant and is discharged to drag-chain conveyors which transport it to a hopper. Measured quantities of starch and accelerator are added to the feed as it is conveyed to the primary mixer. Then resin is fed to a foam generator that discharges in the primary mixer, which is often called the agitating mixer; it stirs the hopper feed, including water, and sends the white goo on to the secondary, or spindle, mixer.

Aside from the additives, this process is mainly that of adding moisture so the material can be worked. Slurry from the spindle mixer is discharged on a layer of paper that is fed continuously to a set of forming rolls, which distribute the mix over the paper to a precise thickness and press a second layer of paper, which passes under the upper roll, on top of the mixture – encasing the gypsum innards of wallboard. Except for the white mix, this operation resembles a tubular newspaper press.

Now encased in paper, the limp, moist board starts on a long conveyor ride. Out ahead are edgers, punches, and a cutting knife that whacks the board into desired lengths.

The board moves slowly some 560 ft. before it reaches the knife; the slow movement and the long distance give the mix time to set before it is cut. When the board is cut, it passes on to a tipple that turns it and lines it up to pass through the drier, which removes much of the moisture that had been added to make the material workable – about 600 lb. per 1,000 sq. ft. of ⅜-in. wallboard. Exhaust fans draw off the moist air.

The result is that the wallboard, aside from the paper and additives, is approximately the same as the gypsum had been in the ground. The finished board goes into the warehouse and on to the platforms from which it is loaded into freight cars.

High-Quality Products

All the way through the plant, regardless of the product being made, the material is carefully tested so that it can be kept above required standards. By sticking steadfastly to high-quality products, Blue Diamond has become one of the nation's leading makers of gypsum products.

Daily production in Nevada runs at approximately 400 tons of sacked gypsum plaster of all types and one million sq. ft. of board and lath products.

THE PLANT: Daily plant production averages 400 tons of sacked plaster and a million sq. ft. of board and lath products. Mine and plant output are keyed closely to sales, thereby minimizing storage problems.

MAKING WALLBOARD: Along the assembly line, the wallboard is cut and passed to a tipple that lines it up for entrance to the drying furnace which removes most of the moisture. Exhaust fans draw off the moist air.

The annual production is sufficient for the construction of 58,000 homes. Mine and plant production are keyed fairly close to sales, and there is comparatively little storage.

Blue Diamond sales have been running over $22 million a year in gypsum products, concrete aggregate, cement, the fabrication and placing of reinforcing steel, and truck mix concrete from eight batch plants located in the Los Angeles area. The company is owned by around 2,500 stockholders. N. J. Redmond is president, W. G. Bradley is vice president in charge of production, T. L. Donoghue is vice president and treasurer, and Leonard W. Ross is vice president.

H. L. Waldthausen, Jr., has been works manager at the Nevada location since 1948. Other department heads include Ed Gutneckht, plant superintendent; Dan Benton, plaster mill superintendent; Floyd Day, maintenance superintendent; M. C. Brooks, mining superintendent; J. H. Cain, assistant mining superintendent; Mark West, maintenance superintendent.

Village of Blue Diamond

Blue Diamond's gypsum works has 260 employes. About 130 live in the nearby village of Blue Diamond and the others reside in Las Vegas and vicinity. The village, with a post office, is located one mile west of the plant. This is one of Nevada's newest towns and one of its most attractive. Up until the time the mill was established near the mine in 1941, the company maintained only a mining camp, with a store and other limited facilities. Now the company-owned village has a population of 400. It has a school, store, post office, medical clinic, swimming pool, and a recreation center which is also a place of worship. Within the past year the Blue Diamond Corporation deeded the school to the Clark County School District.

The village has a voluntary fire department. Law enforcement is in the hands of the Clark County sheriff's office. However, two company employes living in the village are deputy sheriffs, and they keep eyes peeled for any offense against the dignity and peace of the community.

The village is a green, cool-looking spot in a desert land. Rainfall is only about 4 in. annually, but the company has wells 55 ft. deep and they furnish oodles of water for the plant and the

TO THE MARKET: Finished wallboard is hauled in a truck to the platforms for shipment to the market in freight cars. Consistent high quality has established Blue Diamond as one of the nation's leading makers of gypsum products.

DEPARTMENT HEADS: Front, left to right, Floyd Day, maintenance superintendent; Roi Stapley, storekeeper; Gene Carter, sacking foreman; Ken Zahn, employes facilities manager; Harvey Whitney, quality control superintendent. Rear, left to right, Woodrow Hodgson, office manager; Dan Benton, plaster mill superintendent; H. L. Waldthausen, Jr., works manager; Bob White, chief engineer; Ed Gutneckht, board plant superintendent.

village. Within the past year more than 600 new trees were planted in the village which was already lined with shade trees. Television reception in the village is excellent.

During World War II and in the postwar years, Blue Diamond caught quite a few drifters – older men who went broke gambling in Las Vegas. They'd work a short time, raise a little stake, and go into Vegas and lose it. These experiences led Blue Diamond to favor the hiring of married men. That policy has eliminated the rover element. The turnover among employes is negligible. Gay, bright-lighted Las Vegas gives Blue Diamond no serious problems.

Except for daytime heat in the summer, the weather at the mine site is excellent for year-around mining and processing activities. The gypsum works gets its electric power from Southern Nevada Power Company; much of it is generated at Hoover Dam which forms Lake Mead.

New York Water Board's West Delaware Tunnel

Rapid construction progress is highlighted not only by record-breaking tunnel advance but also by instruction courses in first aid for the tunnel employes, with U. S. Bureau of Mines' personnel as teachers

L. J. PAULY, JR.*

EVER since the consolidation, in 1898, of the five counties that now comprise the City of New York, one of the most perplexing problems to confront the City Fathers has been to assure the populace of an adequate supply of pure water to meet the domestic and industrial requirements of the metropolitan area.

To meet these needs, both for the present and the future, the Board of Water Supply of the City of New York was established by an act of the New York State Legislature in 1905. In the establishing act it is specifically stated that this agency is charged with the responsibility for the planning and the construction of all major additions to the City's water systems.

Since its inception, the Board has conducted a never-ending campaign to supply the water requirements of the City's 8,000,000 people, and to anticipate their needs well into the future. Many miles of tunnels have been built to funnel the water tapped from upstate watersheds and mountain streams to strategically located reservoirs that store billions of gallons of water.

At present, men are burrowing through the sandstone and shale deep in the Catskill Mountains to construct another great tunnel, the West Delaware Tunnel. When completed, this tunnel will deliver more than 3,000,000 gallons of water a day to the vast Rondout Reservoir located at Grahamsville, New York.

The job of constructing the West Delaware Tunnel – known as Contracts 451 and 452 – was awarded to a combination of five prominent firms in a joint venture. The five firms are

*Hercules Powder Company
New York 17, New York

WEST DELAWARE TUNNEL: This view of the West Delaware Tunnel from a location near the bottom of one of the shafts shows the size of the unlined tunnel; the rock formation; the pipes for ventilation, water, and air systems; and some of the track and car-switching facilities.

Johnson, Drake & Piper, Inc., New York City; Grafe-Callahan Construction Company, Los Angeles; Tecon Corporation, Dallas; Winston Brothers, Minneapolis; and Conduit and Foundation, Philadelphia. The sponsoring contractor handling the construction details is Johnson, Drake & Piper, Inc. Clancy O'Dell, a veteran tunnel man, is the project manager. Project headquarters are at East Branch, New York.

Rapid progress on the job has been highlighted not only by record-breaking tunnel advance but also by the introduction of an unusual program of safety, including regular instruction courses for the tunnel employes in first-aid work, with U. S. Bureau of Mines' personnel as instructors.

Following the award of this tunnel contract, work began on December 19, 1955, with the breaking of ground near East Branch for the sinking of Shaft 2. Soon afterward, additional work was started at the west portal and at Shaft 1. Since then, activities have progressed continuously on a three-shift-a-day, five-day-a-week cycle.

Contracts 451 and 452

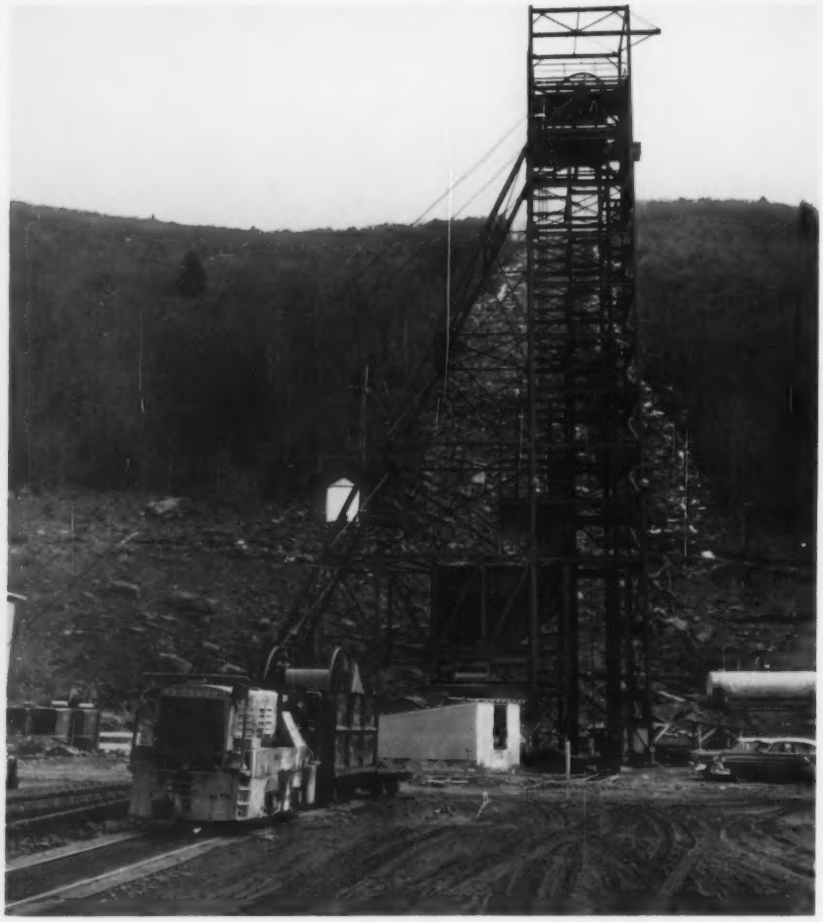
Contract 451 involves the construction of an intake channel, the sinking of Shaft 1 to a depth of 520 ft., and the driving of 8 miles of tunnel. The specifications in contract 452 call for the sinking of two shafts, one 310 ft. deep and the other 458 ft. deep, and the driving of 12 miles of tunnel.

The geological formations encountered in sinking the shafts and driving the tunnels are sedimentary rock, characteristic of that found in the Catskill Mountains. These formations consist of sandstone and shale, varying from red and gray sandstone to gray and red shale. Bedding planes are horizontal with some vertical joints.

In sinking Shafts 1 and 2, it was necessary to strip overburden from 25 to 40 ft. deep. This was handled easily by a clamshell, and the material was hauled away in Euclid diesel trucks. As excavation progressed, steel lining was set in place. When rock was encountered, normal shaft-sinking procedures were followed. At Shaft 3, a slope made possible the use of shovels and bulldozers to make a cut 60 ft. deep before rock appeared. At that point, liner plate was installed, concrete lining poured, and the area around the liner plate backfilled.

The drilling and blasting procedures for sinking the shafts followed conventional methods. It was not practical to use a special drilling rig in the shafts and all drilling was done with jackhammers. The usual round consisted of 60 holes in a standard pyramid cut, with the holes 10 ft. deep. The holes were loaded with Gelamite® 2X in 1¼ by 8-in. cartridges. Rounds were fired with Hercules No Vent® Short-Period Delay Electric Blasting Caps. As an added safety factor, all blasts were fired from a point outside the shaft. An average round pulled 8 ft.

Excavation in the shafts was accomplished with a grapple hung from a Joy air hoist suspended from a monorail at the top of the shaft. The shafts were lined with 6 in. of concrete after reaching a depth of about 100 ft. Water was not a serious factor in sinking Shafts 1 and 3; it was easily controlled with pumping equipment. However, the flow of water at Shaft 2 was sufficiently severe on several occasions to necessitate grouting.



HEADFRAME AT SHAFT 2: The headframe at Shaft 2, 150 ft. in height, is operated by a Superior hoist powered by a 250-hp. electric motor. The speed of the hoisting equipment is rated at 350 ft. a minute. All auxiliary functions are available at each shaft area.

Tunnel Operations

After the shafts were sunk to specified depths, tunnel headings were started in opposite directions. The West Delaware Tunnel has an unlined diameter of 13 ft. 6 in.; when lined with concrete, this is reduced to 11 ft. 4 in. At the bottom of each shaft are large areas extending approximately 100 ft. on each side of the shaft, for the switching of cars, the storage of supplies, the placement of pumps, the dumping devices, and other needed facilities. When these service areas are no longer needed they will

DRILLING IN THE TUNNEL: A specially designed jumbo makes possible the drilling of three to four 12-ft. rounds a day. Some of the crew, with stopers, drill holes for bolts for roof support at the same time a round of blast holes is being drilled.

be filled to the 11-ft. 4-in. diameter.

The outstanding records of progress made at all headings have resulted from the close attention paid to every phase of drilling, blasting, and mucking operations. A special drilling jumbo, designed by the contractor's engineers in cooperation with technical representatives of Gardner-Denver Company, has been a major contributing factor. It is 36 ft. long and rides on a 30-in. gauge track laid in the tunnel. Six Gardner-Denver drifter drills are mounted on it, three on top of the platform and three under the platform. With this drill setup, it is possible to drive three to four 12-ft. rounds a day. The drill steel used is 1¼-in.-round Crucible tipped with 1¾-in. detachable Vascaloy carbide bits. During the regular blast-hole drilling cycle, Gardner-Denver stopers make holes for Republic and Bethlehem 6-ft. slotted wedge-type bolts for roof support. The entire length of the roof is supported by roof bolts, liner plates, and steel ribs.

The contractor is experimenting at several tunnel headings with a specially designed tunnel drilling round using two "burn" cut holes, each 5½ in. in diameter, at the center of the face. These burn-cut holes are drilled with a Gardner-Denver Air-Trac mounted on the jumbo. In this type of round, 50 holes, 1¾ in. in diameter, are drilled 12 ft. deep and perpendicular to the face. This eliminates the more difficult pyramid type of drilling. The larger diameter, unloaded burn-cut holes make excellent relievers. The indications are that they will provide an increase in footage per round.

The holes in a round are loaded with approximately 300 lb. of Gelamite 2X. The dynamite charges are primed with short-period delay electric blasting caps, periods 0 to 9, with 16-ft. plastic-insulated leg wires. The leg wires are connected in parallel and attached to a buss bar. Using No. 14 plastic-insulated wire, the blasting circuit is connected to the permanent shooting line of rubber-covered, solid No. 8 wire. After the drilling crew has been removed from the heading in a work train, the firing of the round is done by the blaster at a transformer station located at a minimum distance of 1,500 ft. from the heading. Each round pulls about 10 ft. of tunnel heading. The powder factor used is estimated at 5 lb. of explosives per cu. yd. of rock. Daily tunnel advance for six rounds is 60 ft. plus.

In drilling blast holes in the west heading of Shaft 2, water gushed through several times but was quickly controlled by grouting. When the heading was advanced about 900 ft., a real gusher was struck and an estimated 300 gal. of water a minute poured into the tunnel. The flow was so severe that drilling operations had to be stopped and a 40-ft. concrete plug built. After the plug was set, grouting operations were required for two weeks before the seams were sealed and normal tunnel operations could be resumed.

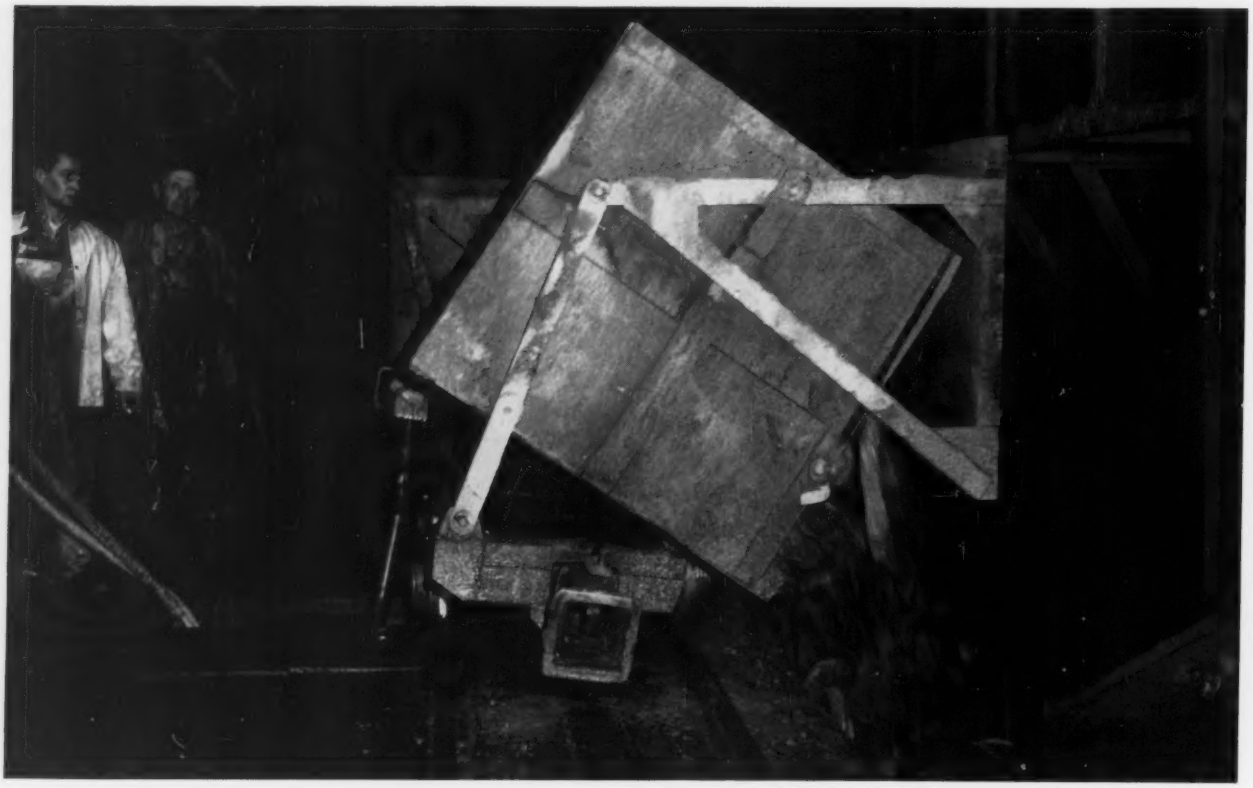
Loading Out the Muck

As soon as feasible after firing a round in the tunnel, an air-powered Eimco tunnel mucker, Model 40H,

THE POWDER CAR: Explosives for loading rounds of drill holes in the tunnel are delivered to the headings in a specially designed car. The car is made of heavy lumber topped with conspicuous explosives warning signs.

and a train of 5-cu. yd. pressed-steel, side-dump cars are moved in by a 10-ton Plymouth diesel locomotive. The blasted rock is loaded out with an Eimco conveyor into the cars. The loaded cars, usually 20, are shifted to the shaft and their contents dumped by a pneumatically actuated arm into an 11-cu. yd. skip in a special pit below the level of the tunnel floor. The skip, manufactured by Penn Ironworks, is lifted by a Superior hoist, powered by 250-hp. electric motors. It can be raised at a speed of 350 ft. a minute. After the muck reaches the surface, it is dumped into a hopper which loads into Euclid diesel trucks for transportation to spoil areas.

A small quantity of methane gas was encountered in one section of the intake heading at about the 900-ft. point of tunnel advance. Fans and fresh-air ducts had sufficient capacity to carry off the gas without it seriously interfering with tunnel progress. Ventilation in the tunnel is provided by two Roots-Connerville blowers that can supply air at a rate of 15,000 c.f.m. at each heading. Naylor pipe is used



AFTER A BLAST: The broken muck from a blast in a heading is side-dumped from 5-cu. yd. pressed-steel cars into an 11-cu. yd. skip located in a special pit below the level of the tunnel floor, and then hoisted to the surface.

throughout the project: 26 in. for ventilation; 21 in. for carrying water; and 6 in. for the compressed air lines.

Each shaft area is a complete unit with all necessary auxiliary functions available right on the spot to assure maximum performance. These include machine and repair shops; compressor houses; warehouses; change houses; first-aid stations, with registered nurses in constant attendance; and office facilities. Whenever possible, all normal maintenance of equipment inside the tunnel is done on Saturdays to avoid interfering with work procedures.

Gardner-Denver double compressors, each 1,100-c.f.m. capacity, supply the shafts and the intake portal with the necessary air to operate the drills and other equipment. Four compressors are located at each shaft area, two for each heading and two at the intake portal.

When ground was broken at Shaft 2, an unusual circumstance was encountered – the almost complete absence of skilled rock-tunnel workers, with the exception of men qualified for supervisory capacities. It was necessary to recruit and train young men in the local communities. However, within a relatively short time, a cohesive team of workmen was put together, a team that worked intelligently and safely.

All operating procedures are directed by a safety-conscious supervisory force, aided and abetted by the management personnel. Work details are based on procedures that provide maximum safety at all times.

First-Aid Training

An example of the thinking of the management is revealed in the action taken following a slight gas ignition in the inlet portal during April, 1956. The U. S. Bureau of Mines was requested to send first-aid representatives to the job location to instruct the tunnel employes in first-aid methods, particularly in regard to the proper methods of handling methane gas emergencies. The Bureau responded and its instruction courses were received so enthusiastically by the tunnel employes that additional courses were added – accident prevention, first aid, and mine rescue. The courses were opened to all the contractor's

(Continued on page 187)

SUPERVISORS: Construction supervisors include Jack Fanning, project mechanical director; Henry Meyers, project electrical superintendent; Clancy O'Dell, project manager; John Hester, general superintendent.

PROJECT ENGINEERS: R. P. King, at right, is project engineer on the West Delaware Tunnel, and Gail Knight is the assistant project engineer.

FRANCIS DONALDSON

PETER F. CONNOLLY

THE MOLES AWARDS

Francis Donaldson and Peter F. Connolly to become the eighteenth pair of recipients of awards given annually by The Moles for outstanding contributions to construction progress

THE Awards committee of The Moles, a New York association of tunnel builders and heavy-construction operators, announced recently that Peter F. Connolly of Osterville, Massachusetts, and Francis Donaldson of Bronxville, New York, have been chosen to receive the Moles Awards for 1958. The awards, considered to be the highest recognition accorded to individuals in the construction industry in the United States, are made each year to an association member and to a nonmember for outstanding contributions to the industry. Mr. Connolly, the member recipient, and Mr. Donaldson, the nonmember, will become the eighteenth pair of honorees in a series that was started in 1941.

Previous winners include former President Herbert Hoover, Admiral Ben Moreell, Robert Moses, Peter Kiewit, Thomas J. Walsh, Harvey Slocum, and Louis R. Perini.

Official presentation ceremonies will take place at the annual dinner of the association on Wednesday, January 29, 1958, at the Waldorf-Astoria Hotel.

Francis Donaldson

Francis Donaldson has been vice president and a director of the New York firm of Mason & Hanger since 1936. During the previous quarter-century, he was prominently identified as construction engineer on many outstanding projects. One of his best-known accomplishments was in designing braced open cofferdams that solved difficult problems in the construction of the foundations of the New Jersey towers for the George Washington Bridge. He played a prominent role in the building of the Lincoln Tunnel and the Brooklyn-Battery in New York, and the Ray's Hill Tunnel on the Pennsylvania Turnpike.

Peter F. Connolly

Peter F. Connolly, president of the company which bears his name, directs an organization concerned primarily with tunnel and pneumatic caisson work. His construction career began on the East Boston Tunnel job in 1902. Six years later, he formed his own company. Since then, he and his associates have built water works in Cleveland and Akron, Ohio, and completed important tunnels for the New York Board of Water Supply – one a $44-million contract in the early 1930's. During World War II, Mr. Connolly was project manager for the joint-venture building of the U. S. Navy's third air base on the island of Trinidad.

Miners and Quarrymen Receive Top Safety Awards

Six winners in the National Safety Competition awarded Sentinels of Safety trophies and flags at impressive ceremonies

AT BIWABIK, MINNESOTA: Fred A. Seaton, Secretary of the U. S. Department of the Interior, made the official award of the bronze Sentinels of Safety trophy to the Embarrass Mine of Pickands Mather & Company in the open-pit classification.

THROUGH the years, the National Safety Competition has provided an unusual and powerful medium for stimulating and maintaining interest in accident prevention in the mineral industry in the United States. It was conceived in 1924, at a conference in Washington, D. C., called by the then-Secretary of the U. S. Department of Commerce Herbert Hoover. Mr. Hoover became concerned about the rising trend of lost-time injuries in the mines and quarries throughout the nation, and was anxious to determine what could be done to reduce the number of these on-the-job injuries. The subject was a familiar one to him because of his training and experience as a mining engineer, and his extensive contacts with mining operations both here and in lands across the seas.

Among the men invited to the conference was the editor of THE EXPLOSIVES ENGINEER. During the discussions, the editor proposed that a competition be started among the mines and quarries in the United States to determine which operated with the best safety record. He further proposed that an appropriate trophy be awarded annually to the winners, the trophies to be provided by THE EXPLOSIVES ENGINEER. Both proposals were approved by Mr. Hoover and the participants in the conference.

It was decided to set up three groups of contestants – coal and metal mines, and a combination of open-pit mines and quarries. Later, these groups were expanded to include the present six classifications.

Begni del Piatta, a prominent sculptor, was commissioned to design the

trophy. His design was accepted and six bronze statuettes were made and designated Sentinels of Safety. They are awarded to each of the six winners of the National Safety Competition each year by the U. S. Bureau of Mines.

The competition began in the calendar year 1925 with 210 operations enrolled. At the end of the year, only seven operations had worked the 12 months without a lost-time injury. In the 1956 contest, 525 mines and quarries competed and 222, more than 42 per cent, had perfect safety records.

Open-Pit and Metal Mines

Recently, Pickands Mather & Company celebrated the winning of top honors in two groups of the competition for the third successive year. Its two winning mines were the Embarrass Mine at Biwabik, Minnesota, in the open-pit classification, and the Buck Mine at Caspian, Michigan, in the metal group.

At the awards ceremony at Embarrass Mine, Fred A. Seaton, Secretary of the U. S. Department of the Interior, participated in the program and officially presented the Sentinels of Safety trophy to T. C. Thielman, general superintendent of the mine. Decrying the efforts of some economic planners to put the Federal Government into mining and other businesses, Secretary Seaton said: "The splendid achievement marked by the National Safety Competition award has not been accomplished by a government bureaucracy, but by the employes and management of private industry working together to prevent accidents and to save lives."

The Sentinels of Safety flag was presented by Thomas E. Miller, associate editor of THE EXPLOSIVES ENGINEER, to Frank Masera, chairman of Embarrass Mine's Employes Safety Committee.

During the ceremonies at the Buck Mine in Caspian, Michigan, the bronze trophy was presented by John A. Johnson, chief of the Safety Division, U. S. Bureau of Mines, to W. E. Seppanen, superintendent of the mine. The miners were congratulated by E. L. Joppa, general manager of PM's mines in the Lake Superior District, for the progress made in accident prevention at Buck Mine. In his remarks, Mr. Joppa said: "You may not realize the contributions made to the advancement of safe operations by our suppliers, the companies that sell us equipment and materials for our mines. I am thinking at this time of the manu-

"TO THE COLORS": As a Boy Scout bugler blows "To The Colors," two of his Scout associates prepare to raise the Sentinels of Safety flag over Embarrass Mine, assisted by Harold Sawyer, mine patrolman.

AT CASPIAN MICHIGAN: Allen D. Look, superintendent of health and safety, Duluth District, U. S. Bureau of Mines, presents a Joseph A. Holmes award to Peter Lucci, representing the employes of Pickands Mather's Buck Mine.

Anthracite Mines

The presentation ceremonies of the Penag Coal Company for the employes of its Goodspring Mine were held in Tremont, Pennsylvania. Edward V. Twiggar, mine superintendent, was master of ceremonies. This ceremony was marked by a deep feeling of rapport between the miners and the management personnel on the matter of accident prevention.

In accepting the Sentinels of Safety trophy and flag from Mr. Miller, H. Wilson Lark, owner of the mine, said: "Nothing is more important than that you men return home safely to your families every day, to enjoy the comforts of life surrounded by your wives and children."

Harry F. Weaver, of the U. S. Bureau of Mines, presented individual Certificates of Achievement in Safety to the mine employes. The certificates were accepted by Mine Foremen Calvin Miller, Clarence Miller, and Kosier Miller for later distribution to their associates in the mine.

John Eagan, vice president of Dis-

facturers of explosives. They have made great improvements in their products and in the methods of handling and using them. The equipment manufacturers have also helped by introducing many safety devices in their products." All of these contributions have been remarkably effective in helping to prevent accidents in our mines.

Mr. Miller, of the ENGINEER staff, presented the Sentinels of Safety flag to the mine through its representative Eli Millette, a member of Buck Mine's Employes Safety Committee.

Bituminous-Coal Mines

At the ceremony at Wylam, Alabama, honoring the employes of Edgewater Mine of the Tennessee Coal & Iron Division of U. S. Steel Corporation, Mr. Miller made the presentations of the Sentinels of Safety trophy and flag. In congratulating the miners, he said: "If we had before us the figures on safety from all underground bituminous-coal mines, I am confident that Edgewater's record would be the best of any similar mine in the world."

AT WYLAM, ALABAMA: Following ceremonies at Edgewater Mine of the TCI Division of U. S. Steel, the photographer took a picture of G. W. Postell, superintendent of the mine; M. C. McCall, district representative, U. S. Bureau of Mines; and W. E. Crouch, Jr., TCI's vice president of operations.

AT TREMONT, PENNSYLVANIA: In presenting the Sentinels of Safety trophy and flag to Goodspring Mine of Penag Coal Company, Thomas E. Miller, associate editor of The Explosives Engineer, left, extends congratulations to H. Wilson Lark, Penag's president.

trict 9, U. M. W. of A., recalled the early days of anthracite mining in Pennsylvania and the rivalry that existed between the Irish, Polish, Welsh, and English nationalist groups. He paid tribute to the employes and the management personnel of Goodspring Mine for the great strides made in safety practices and the marked reduction in accidents over the years.

Quarries

The winning awards in the quarry group were made to the Alpena Quarry of Wyandotte Chemicals Corporation at Alpena, Michigan, during a dinner meeting attended by the quarry workers and their wives. Allen D. Look, superintendent of health and safety, Duluth District, U. S. Bureau of Mines, presented Certificates of Achievement in Safety, and the Joseph A. Holmes award to the quarry. Following the awards of the Sentinels of Safety trophy and flag, Robert B. Semple, president of Wyandotte Chemicals Corporation, praised the excellent teamwork of the quarry employes, which resulted in a perfect safety record in 1956, the third time Alpena Quarry had won the coveted trophy.

Nonmetallic Mines

The award of top honors to the Bell Mine of Warner Company at Bellefonte, Pennsylvania, was the second straight year in which this limestone mine had achieved the best safety record in the underground nonmetallic group. The Sentinels of Safety trophy and flag were presented by Mr. Miller to Pat Corre, superintendent of Bell Mine. Commenting on the mine's winning record in 1956, Fred Warner, general superintendent, commented: "It looks to me as though we are beginning to get the upper hand in this business of working safely." The mine has had six full years without a lost-time accident, 1932, 1937, 1951, 1954, 1955, and 1956, three of them in the last six years.

AT ALPENA, MICHIGAN: William E. Hagan, superintendent of Alpena Quarry of Wyandotte Chemicals Corporation, left, accepts the bronze trophy and the green-and-white flag from Thomas E. Miller of The Explosives Engineer staff.

THE WINNERS: The Shaft 1 first-aid team was the winner of the meet with a score of 99.05 per cent. The team members, left to right, Elmer Schofield, Clifford Rappleyea, Charles Besley, Charles Craft, Orvin Eckert, Larry McCauley, and Lawrence Hull, are pictured with Clancy O'Dell, project manager, and Joseph V. Aspenleiter, safety director.

New York Water Board's West Delaware Tunnel

(Continued from page 181)

crews. To insure continued attendance, the management paid the men their normal wage rates for the time spent in classes.

Since the introduction of these instruction courses, more than 600 of the contractor's employes on the West Delaware Tunnel project have been trained in accident prevention, first aid, and mine rescue. Two full teams are at each location to take care of any emergency.

In a recent statement, Joseph V. Aspenleiter, director of safety on the project, said: "The culmination of all of our training courses was a first-aid contest in July in East Branch, under the direction of U. S. Bureau of Mines' officials. Five teams of our tunnel employes participated in working various problems given by the Bureau's representatives. It was the first such contest ever held in New York State with tunnel men the participants."

The team from Shaft 1 was the winner and was awarded first prize, an all-expense-paid trip to Louisville, Kentucky, to compete in the National First Aid Contest. The members of Shaft 1 team were accompanied by their wives. The contractor also paid the expenses of the womenfolk. The local team did not win first place in the National event, but they made a very creditable showing in competition with the best teams from all sections of the country.

Assisting Clancy O'Dell, the project manager on the West Delaware Tunnel job, are Gail Knight, assistant project engineer; R. P. King, project engineer; John Hester, general superintendent; Jack Fanning, mechanical superintendent; Joseph V. Aspenleiter, safety director; and R. J. Coffey, office manager. The superintendents at the principal operating locations on the project are J. C. "Sparky" Mathis, intake portal; Norman Keene, Shaft 1; C. P. "Red" Gatrell, Shaft 2; and Joe Walker, Shaft 3.

Representing the Hancock Division of the Board of Water Supply of the City of New York on this big rock-tunnel job are W. Courtland Thomas, division engineer, and Meyer K. Barkin, senior section engineer.

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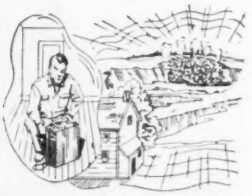

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Professor Neumann is now available to serve as your consultant in industrial vibration problems, especially blasting, to make vibration measurements, analyze the data, prepare report, and testify in legal proceedings.

He may be contacted as follows:

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Seattle 5, Washington
Melrose 0630, Ext. 3367

Residence
4546 45th Ave., N.E.
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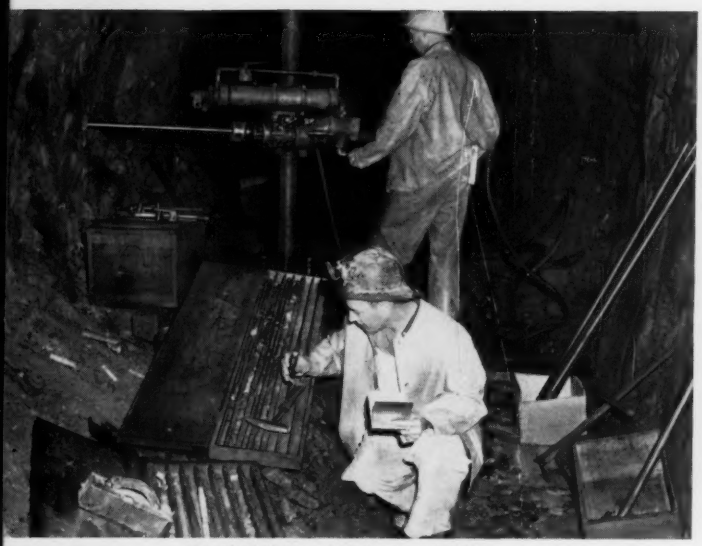

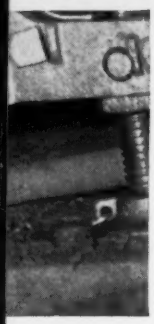

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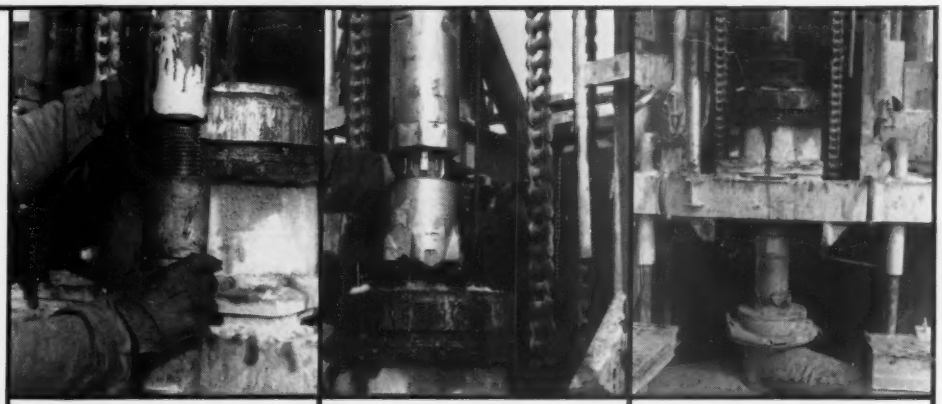
Two sizes available—here are the condensed specifications

	diameter	length	weight	recommended bit size
Model AM6	5¾"	38.6	200 lb.	6½"
Model AM4	4"	35.6	98 lb.	4¾"

Get the most out of your rotary drilling rig . . . save money . . . drill faster . . . get the new Gardner-Denver "Mole-Dril"

Patent Pending



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Bit screws directly on to drill tappet . . .

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Textile-covered, flexible and resilient. Suitable for surface trunk lines and shallow holes where tensile strength and resistance to abrasion and cutting are not required. Tensile strength 125 lbs. 1000-ft. spool 17 lbs.

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QUARRYCORD

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